**T08D04 : pH and the Equilibrium Constant for Water**

Name …………………………………………

**Part A: Essentials**

Water will ionize(dissociate) into its ions according to the following equation

H2O (l)  H+ (aq) + OH- (aq)

The equilibrium constant for water is therefore

Kw  = [ H+] [OH-] and its value is

1 x 10-14 at 25 degrees C. This value means that \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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In comparison the equilibrium value for HCl is exceedingly large \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Part B: The Formulas and Problems**

The formula for pH is :

The additional formulas derived from the pH and Kw formulas are:

1. Using this formula calculate the pH of the following:

a. [H+] = 1.67 x 10-4 .....................

b. [H+] = 1.1 x 10-5 .....................

c. [H+] = 1.8 x 10-11 .....................

d. [H+] = 5.5 x 10-6 .....................

2. Calculate the **pH** of the solutions that have the following concentrations of **hydrogen** or **hydroxide** ions:

a. [H+] = 1.67 x 10-4 .....................

b. [OH-] = 1.1 x 10-5 .....................

c. [H+] = 1.8 x 10-11 .....................

d. [OH-] = 5.5 x 10-6 .....................

3. Calculate the hydrogen ion concentration, [H+], and the hydroxide ion concentration , [OH-] of each of the f ollowing solutions given their pH:

pH pOH [H+] [OH-]

a. 2.9 \_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

b. 5.5 \_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

c. 10.1 \_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

d. -1.4 \_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

4. Fill in the following table:

[H+] [OH-] pH pOH

............ ............ 1.9 ............

............ 1.5 x 10-4 ............ ............

............ ............ ............ -0.60

2.3 x 10-2 ............ ............ ............

............ ............ 5.5 ............

0.000155 ............ ............ ............

5. Calculate the pH, pOH, [H+] , and [OH-] concentration of each of the following:

a. 1.0 M solution of HNO3

b. 0.65 M solution of NaOH

c. 13.45 g of H2SO4 placed in water to make 325 mL of solution. [Diprotic acid but only the first ionization step should be used.]